

WHAT IS CLAIMED IS

1. An isolated nucleic acid comprising a polynucleotide that encodes a polypeptide of either one of SEQ ID NOS: 2 or 6.
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2. A vector comprising at least one nucleic acid of claim 1.
3. An expression cassette comprising at least one nucleic acid of claim 1
10 operably linked to a promoter, wherein the nucleic acid is in sense or antisense orientation.
4. A non-human host cell into which is introduced at least one expression cassette of claim 3.
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5. The host cell of claim 4 that is a plant cell.
6. A transgenic plant comprising at least one expression cassette of claim 3.
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7. The transgenic plant of claim 6, wherein the plant is maize, soybean, alfalfa, sunflower, *Brassica*, cotton, sorghum, wheat, barley, millet, rice, cassava, potato, *Arabidopsis*, tomato, pepper, apple, spinach, or lettuce.
8. A seed from the transgenic plant of claim 6.
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9. The seed of claim 8, wherein the seed is from maize, soybean, alfalfa, sunflower, *Brassica*, cotton, sorghum, wheat, barley, millet, rice, cassava, potato, *Arabidopsis*, tomato, pepper, apple, spinach, or lettuce.
10. An isolated nucleic acid comprising a polynucleotide having at least 73%
30 sequence identity to either one of SEQ ID NOS:1 or 5, or a complement thereof, wherein the % sequence identity is based on the entire coding

sequence and is determined by BLAST 2.0 using default parameters, wherein said polynucleotide encodes a starch synthase.

11. A vector comprising at least one nucleic acid of claim 10.
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12. An expression cassette comprising at least one nucleic acid of claim 10
operably linked to a promoter, wherein the nucleic acid is in sense or antisense
orientation.
- 10 13. A host cell into which is introduced at least one expression cassette of claim 12.
14. A transgenic plant comprising at least one expression cassette of claim 12.
- 15 15. A seed from the transgenic plant of claim 14.
16. An isolated nucleic acid comprising a polynucleotide which hybridizes under
high stringency conditions to a polynucleotide having the sequence set forth in
either one of SEQ ID NOS:1 or 5.
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- 20 17. A vector comprising at least one nucleic acid of claim 16.
18. An expression cassette comprising at least one nucleic acid of claim 16
operably linked to a promoter, wherein the nucleic acid is in sense or antisense
orientation.
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19. A non-human host cell into which is introduced at least one expression cassette
of claim 18.
20. A transgenic plant comprising at least one expression cassette of claim 18.
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21. A seed from the transgenic plant of claim 20.

PCT/EP2017/062115

22. An isolated nucleic acid comprising a polynucleotide comprising the sequence set forth in either one of SEQ ID NOS:1 or 5, or a complement thereof.

5 23. A vector comprising at least one nucleic acid of claim 22.

24. An expression cassette comprising at least one nucleic acid of claim 22 operably linked to a promoter, wherein the nucleic acid is in sense or antisense orientation.

10 25. A host cell into which is introduced at least one expression cassette of claim 24.

26. A transgenic plant comprising at least one expression cassette of claim 24.

15 27. The transgenic plant of claim 26, wherein the plant is maize, soybean, alfalfa, sunflower, *Brassica*, cotton, sorghum, wheat, barley, millet, rice, cassava, potato, *Arabidopsis*, tomato, pepper, apple, spinach, or lettuce.

28. A seed from the transgenic plant of claim 26.

20 29. The seed of claim 28, wherein the seed is from maize, soybean, alfalfa, sunflower, *Brassica*, cotton, sorghum, wheat, barley, millet, rice, cassava, potato, *Arabidopsis*, tomato, pepper, apple, spinach, or lettuce.

25 30. An isolated nucleic acid comprising a polynucleotide encoding a starch synthase from *Cucurbita zedoaria* or a complement thereof.

31. A vector comprising at least one nucleic acid of claim 30.

PCT/US2010/035100

32. An expression cassette comprising at least one nucleic acid of claim 30 operably linked to a promoter, wherein the nucleic acid is in sense or antisense orientation.

5 33. A non-human host cell into which is introduced at least one expression cassette of claim 32.

10 34. The host cell of claim 33 that is a plant cell.

15 35. A transgenic plant comprising at least one expression cassette of claim 32.

20 36. The transgenic plant of claim 35, wherein the plant is maize, soybean, alfalfa, sunflower, *Brassica*, cotton, sorghum, wheat, barley, millet, rice, cassava, potato, *Arabidopsis*, tomato, pepper, apple, spinach, or lettuce.

25 37. A seed from the transgenic plant of claim 36.

30 38. The seed of claim 37, wherein the seed is from maize, soybean, alfalfa, sunflower, *Brassica*, cotton, sorghum, wheat, barley, millet, rice, cassava, potato, *Arabidopsis*, tomato, pepper, apple, spinach, or lettuce.

39. A method for modulating the level of starch synthase protein in a plant, comprising:

25 (a) stably transforming a plant cell with a starch synthase polynucleotide of Claim 1 operably linked to a promoter, wherein the polynucleotide is in sense or antisense orientation;

30 (b) growing the plant cell under plant growing conditions to produce a regenerated plant capable of expressing the polynucleotide for a time sufficient to modulate the level of starch synthase protein in the plant.

PCT/US2011/038115

40. The method of claim 39, wherein the plant is maize, soybean, alfalfa, sunflower, *Brassica*, cotton, sorghum, wheat, barley, millet, rice, cassava, potato, *Arabidopsis*, tomato, pepper, apple, spinach, or lettuce.

5 41. The method of claim 39, wherein starch synthase protein is increased.

42. The method of claim 39, wherein starch synthase protein is decreased.

10 43. A method for modulating the morphology and/or amount of starch in a plant, comprising:
(a) stably transforming a plant cell with a starch synthase polynucleotide of Claim 1 operably linked to a promoter, wherein the polynucleotide is in sense or antisense orientation;
(b) growing the plant cell under plant growing conditions to produce a regenerated plant capable of expressing the polynucleotide for a time sufficient to modulate the morphology and/or amount of starch in the plant.

15 44. The method of claim 43, wherein the starch exhibits altered degree of crystallinity.

20 45. The method of claim 43, wherein the starch exhibits altered temperature of gelatinization.

25 46. The method of claim 43, wherein the starch exhibits altered density.

47. The method of claim 43, wherein the starch exhibits altered digestibility.

30 48. The method of claim 43, wherein the starch exhibits altered level of covalently bound phosphate.

49. The method of claim 43, wherein the starch exhibits altered branching patterns.

50. The method of claim 43, wherein the starch exhibits altered degree of polymerization.

51. The method of claim 43, wherein the starch exhibits altered average chain length.

10 52. The method of claim 43, wherein the starch exhibits altered rate of retrogradation.

15 53. The method of claim 43, wherein the starch synthase polynucleotide comprises either one of SEQ ID NOS: 1 or 5 or functional derivatives thereof.

54. The method of claim 43, wherein the plant is *Zea mays*.

20 55. The method of claim 54, wherein the starch exhibits altered granule diameter in the range of 31 μm to 100 μm .